

Global Response to Comments on Dissolved Oxygen Concentration

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Concern exists that, following herbicide treatment, the large biomass of decaying plant material will create a large biochemical oxygen demand, resulting in decreases in dissolved oxygen. Such decreases could result in a violation of Basin Plan standards for dissolved oxygen and adversely impact fish. DBW acknowledges that the use of certain herbicides under certain environmental conditions could result in a decrease in dissolved oxygen. However, DBW also contends that with adequate avoidance measures, decreases in dissolved oxygen can be avoided and/or minimized. The following points are discussed briefly below: (1) DO levels in *Egeria* beds; (2) decreases in DO following herbicide use; (3) long-term benefit of treating with respect to DO; (4) feasibility of removing weeds following treatment; (6) mitigation measures.

It should be noted that the DBW is currently in formal consultation with USFWS and NMFS as required under section 7 of the Endangered Species Act. Revised measures to avoid or minimize impacts to dissolved oxygen that were adopted through this process are described below under “Avoidance and Minimization Measures”.

DO Levels in *Egeria* Beds

The spread of *Egeria* outside its native range has been attributed to the fact that it was once considered to be an important “oxygenator” for ponds and aquaria and thus became widely available as an aquarium plant (Cook and Urmi-Konig 1984). Ironically, it has been found that *Egeria* actually depresses oxygen levels (Cook and Urmi-Konig 1984, *Grimaldo and others, In Prep.*). DO may be low in dense beds of *Egeria* especially at night and early morning when respiration rates are high. Further, it has been suggested that the reduced temperature and reduced oxygen concentration within *Egeria* stands may be, in fact, limiting for certain fish species.

Grimaldo and others (*In Prep*) sampled dissolved oxygen in beds of *Egeria* as part of a 16-month study at three breached levee wetlands in the Delta. Sample sites were shallow subtidal areas (< 4 m) mostly colonized by submerged aquatic vegetation (SAV); the dominant species at all sites was *Egeria*. Grimaldo compared bottom dissolved oxygen concentration in three different environments: sites characterized by open beaches, mudflats, and no SAV; sites with 5-10 percent coverage by SAV; and sites with greater than 25 percent coverage by SAV. An analysis of variance indicated that there was a significant difference between dissolved oxygen at sites with no SAV and those with greater than 25 percent coverage ($p=0.014$). Overall average DO in the environment with no SAV was 9.1 mg/L, while it was 7.7 mg/L at the sites with greater than 25 percent coverage (Grimaldo, unpublished data). (Averaged DO at sites with 5 to 10 percent coverage was 8.4 mg/L.) These results indicate that, indeed, dissolved oxygen levels can be lower in beds of aquatic weeds dominated by *Egeria*. Given this relationship, it is likely that the presence of *Egeria* in the Delta is adversely impacting fish habitat, especially during the summer months when dissolved oxygen levels naturally tend to be low. Thus, a net decrease in the amount of *Egeria* in the Delta would likely benefit native fish in the Delta by improving habitat conditions.

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Decreases in DO Following Herbicide Use

The use of aquatic herbicides can result in decreases in dissolved oxygen, especially if appropriate avoidance measures are not taken. As indicated in the EIR, such decreases may occur following the use of Reward. DBW believes that such decreases can be avoided with proper avoidance measures. (These measures will be discussed below under “Avoidance and Minimization Measures”).

However, research indicates that such DO sags do not typically occur following the proper use of Sonar and Komeen. Sonar is a slow-acting systemic herbicide that can take 30 to 60 days to produce its herbicidal effect on the target population (McLaren/Hart Environmental Engineering Corp., 1995). Thus, addition of organic material into the water column would be slow. McLaren/Hart Environmental Corp. (1995) cite various researchers (Parka and others 1978, Struve and others 1991) who reported that Sonar applications of up to 0.125 ppm have not resulted in significant decreases in dissolved oxygen content. In field tests conducted by Arnold (1979), fluridone in an aqueous solution at application rates of up to 1.0 ppm did not affect water quality parameters such as dissolved oxygen, pH, biochemical oxygen demand (BOD), color, dissolved solids, hardness, nitrate, specific conductance, total phosphates, and turbidity.

Komeen use is not expected to result in decreased dissolved oxygen, and thus is not likely to adversely affect the habitat of special status fish in the Delta. Although Komeen is a fast-acting herbicide, and thus could potentially cause a rapid decrease in dissolved oxygen due to the decomposition of organic matter, data suggest that Komeen does not cause such decreases. Anderson (pers. comm. 1999) did not detect any change in dissolved oxygen following Komeen application at Del's Harbor in the South Delta during USDA field trials conducted in 1999. Pretreatment dissolved oxygen concentrations taken in April and May ranged from approximately 6.0 to 7.5 mg/L, while post-treatment concentration taken in June ranged from approximately 5.8 to 7.8 mg/L. Likewise, following Komeen treatment by the Department of Water Resources at Clifton Court Forebay in the Delta during May 1995, dissolved oxygen concentration remained high, at values greater than 90 percent saturation (DWR, 1995). These data suggest that decreases in dissolved oxygen following Komeen application are unlikely to occur, at least during the spring and early summer period.

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Long-Term Benefit of Treating with Herbicides

Treating with herbicides may in some instances result in a localized sag in DO, despite avoidance and minimization efforts. However, such decreases will likely be short-term since the Delta is a flowing rather than a standing water system, and in most instances, the DBW would not be treating in back-water areas. One of the long-term benefits of treating with herbicides is that the volume of *Egeria* in the Delta will be decreased. Since beds of *Egeria* are not good habitat for sensitive fish due to their high density and low dissolved oxygen content, an overall reduction in *Egeria* biomass would benefit these species. It can be argued that such a benefit outweighs the impact of short-term localized decreases in dissolved oxygen.

Feasibility of Mechanical Harvesting/Weed Removal Following Treatment

Several comments suggest that mechanical harvesting would be preferable to herbicide treatments due to the potential for DO impacts. Other comments suggest that weeds be removed following herbicide treatment to avoid decreases in dissolved oxygen. Both of these suggestions are infeasible due to the large scale of the EDCP and Komeen Trials. It is difficult to pursue mechanical harvesting or weed removal following herbicide treatment on a large scale due to the following operational constraints:

- ❑ Harvested *Egeria* will produce fragments of plant material that, if not collected and disposed of properly, would greatly contribute to the spread of *Egeria*. Despite the efforts of harvesting contractors to collect all viable plant fragments, due to the volume of plant material generated, many fragments would float away before collection could occur.
- ❑ In larger bodies of water, harvesting logistics may be overwhelming. It would be difficult to capture the large amount of harvested *Egeria* and haul it to an appropriate disposal facility.
- ❑ In deep waters, the harvester may not reach all of the *Egeria*.
- ❑ Using mechanical harvesting while *Egeria* is still actively growing could enhance its growth rate. In many cases, *Egeria* also will grow back to levels present prior to harvesting.
- ❑ Finding disposal sites for *Egeria* is difficult due to its high water content (approximately 93 percent). This moisture content is considered too excessive for a Class III landfill, thus DBW must find alternative sites for disposal. DBW proposes to dispose of harvested *Egeria* on fallow agricultural land in the Delta.
- ❑ Disposal of harvested weeds is labor intensive and, if harvesting were done on a large scale, would require a significant amount of acreage. Results from the DBW research trials indicate that between $\frac{3}{4}$ to $3\frac{1}{3}$ tons (wet weight) of *Egeria* would be produced per acre harvested. Harvested *Egeria* must then be moved to a disposal site. The plant material is then manually spread to a depth of no more

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than one foot and left to dry for approximately 30 days. Once dry, harvested *Egeria* is then disked into the soil.

For these reasons, it is not feasible to mechanically harvest more than approximately 50 acres per year (the area proposed under the EDCP). Likewise, removal of vegetation treated with herbicides is not feasible due to the scale at which herbicide treatment will occur (1,500-1,750 acres per year under the EDCP and 300 acres per year under the Two Year Komeen Research Trials.)

Avoidance and Minimization Measures

The following avoidance and minimization measures were proposed in the Draft EIR:

Significant decreases in dissolved oxygen can be greatly reduced or avoided entirely by adhering to certain avoidance and minimization measures. Prior to any herbicide treatment, dissolved oxygen would be measured throughout the water column. If concentrations in the hypolimnion were less than 5 ppm, treatment would be postponed until levels increase above this limit. The DBW would treat no more than 20 acres per day at a given treatment site. During late summer and fall (when DO in the hypolimnion is typically lowest), no more than 20 acres would be treated at a given treatment site over a 14-day period.

Through the formal consultation process with USFWS and NMFS, the following avoidance and minimization measures were adopted by the DBW:

- a. No treatment using Reward and Komeen if pre-treatment dissolved oxygen levels are as follows:
 - Low flow areas: between 4 and 6 ppm
 - High flow areas: below 5 ppm
- b. Provide a protocol to the USFWS for dissolved oxygen monitoring
- c. Develop operator procedures based upon actual operations for the first and second year (i.e., using adaptive management)
- d. Establish a review committee to examine monitoring results.